Space Weather Technical Forecast

Issued on Thursday, 07 July 2022 at 13:12 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: G1/Minor Geomagnetic Storms likely Day 1 (07 July), with risk decreasing through the period. Slight chance of R1-R2 radio blackouts. Increasing slight chance of Active fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Low with only minor C-class flares. There are currently six sunspot regions on the visible disc, with the most complex being AR3053 in the northeast quadrant. The remaining regions are relatively small and stable. The C9.8 flare from AR3047 (which has now faded and no longer appears on current analysis) produced a very faint partial halo CME (Coronal Mass Ejection) in coronagraph imagery. This may give a glancing blow at Earth on Day 2 (08 July), although confidence is low. No other Earth-directed CMEs have been observed in available imagery over the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 by DSCOVR, has shown a weak CME arrival, starting around 07/0600 UTC, perhaps combined with the onset of the HSS from CH97/+. Wind speed was ambient between 300-330 km/s, but saw a step-wise increase from 07/0600 UTC and is now just above 400 km/s. The density was slightly above average, but jumped after 07/0600 UTC peaking well above average at 55 ppcc. The IMF was weak, but jumped briefly to moderate levels around 07/0810 UTC, before becoming strong at 07/1045 UTC. The Bz varied weakly, but started to vary more strongly after 07/1100 UTC with a peak of -16nT. The phi angle was predominantly positive (away from the Sun), but became more variable from 07/0600 UTC. Geomagnetic activity was Quiet (Kp 0-2), with an Unsettled (Kp 3) interval 07/0900-1200 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16, remained at background levels throughout the period. The high energy electron flux (greater than 2MeV) has also been at background levels through the last 24 hours. Electron fluence was well below the Active (1e8 integrated pfu) threshold. Observed fluence was 2.06e6 integrated pfu at 07/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Low, with a Slight Chance of isolated M-class flares. An increase is possible through the period as returning regions potentially rotate onto the eastern limb.

Solar Wind / Geomagnetic Activity: Earth may experience a glancing blow from a CME which occurred on 05 July from AR3047. This CME was difficult to assess but it gave a faint partial halo in SOHO imagery and as such a low confidence glancing blow is possible on Day 2 (08 July). Otherwise it appears that Earth has recently experienced a weak CME arrival, combined with the onset of the HSS from CH97/+. Slightly elevated or perhaps elevated wind speeds could last through to Day 3 (09 July).
Geomagnetic activity is expected to be Unsettled to Active with G1/Minor Storm intervals likely

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

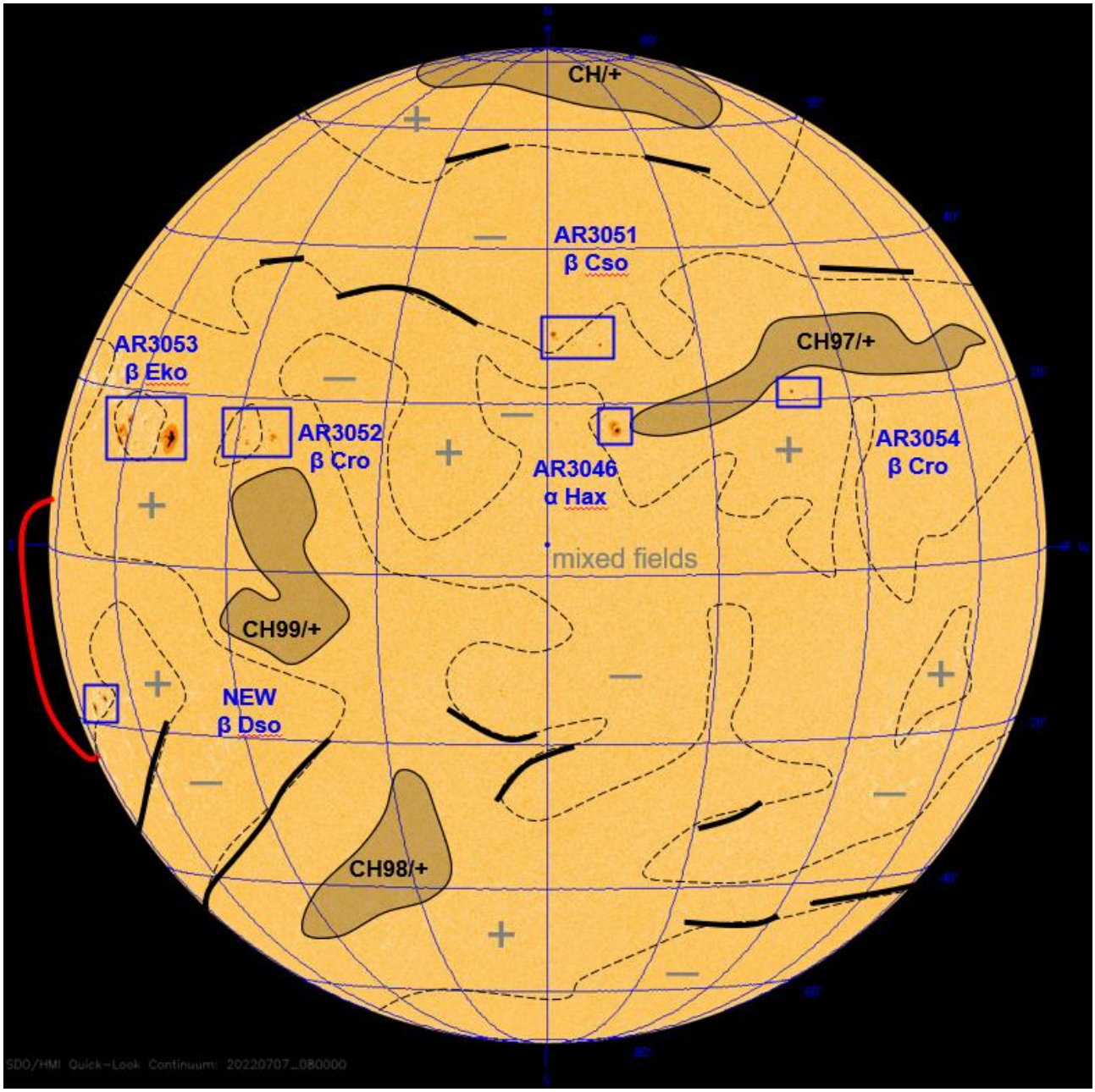
on Day 1 (07 July) due to combined HSS and CME effects. Activity should decline through Day 3 to be mainly Quiet on Day 4 (10 July).

Energetic Particles / Solar Radiation: In the absence of any significant sunspot development, the high energy proton flux (greater than 10 MeV) is likely to remain at background levels. Probabilities increase very slightly as AR3053 moves towards centre disc.
The high energy electron flux (greater than 2MeV) might increase through this period, however confidence is low. Electron fluence is most likely to remain below the Active threshold, although this carries a degree of uncertainty due to uncertainty in HSS wind speeds and the possibility of CME effects. An upward trend is possible following any coronal hole connection but with low confidence for the magnitude of this.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 1. Solar Analysis Valid 07/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

Earth may experience a glancing blow from a CME which occurred at 05/0407 UTC from AR3047. This CME was difficult to assess as it was faint and contaminated by a far sided CME which was visible at the same time. However, it gave a faint partial halo in SOHO imagery and as such a low confidence glancing blow is possible on Day 2 (08 July).

Otherwise it appears that Earth has recently experienced a weak CME arrival, combined with the onset of the HSS from CH97/+. The longitudinal extent of this CH suggests that slightly elevated or perhaps elevated wind speeds could last through to Day 3 (09 July).
Geomagnetic activity is expected to be Unsettled to Active with G1/Minor Storm intervals likely on Day 1 (07 July) due to combined HSS and CME effects. Activity should decline through Day 3 to be mainly Quiet on Day 4 (10 July).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	60	30	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

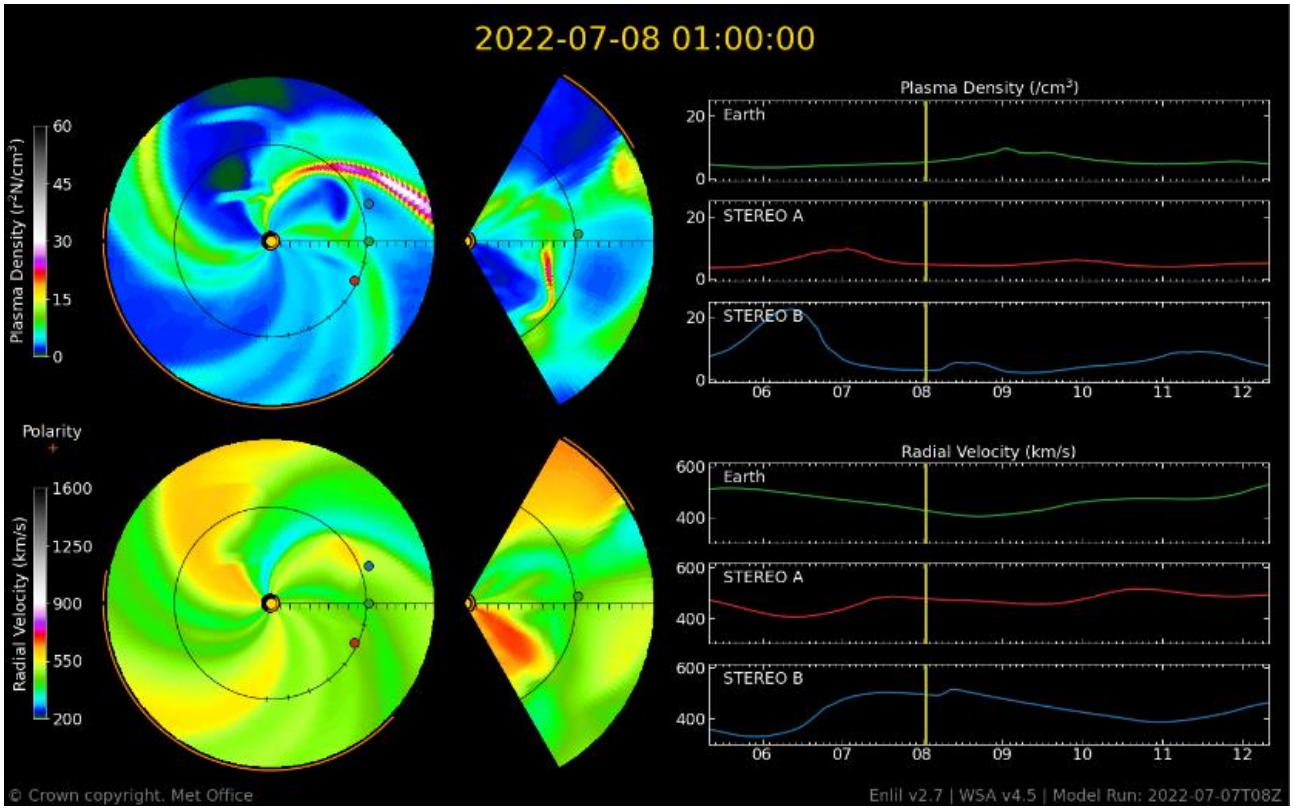
Geomagnetic Activity - Earthbound Coronal Mass Ejections

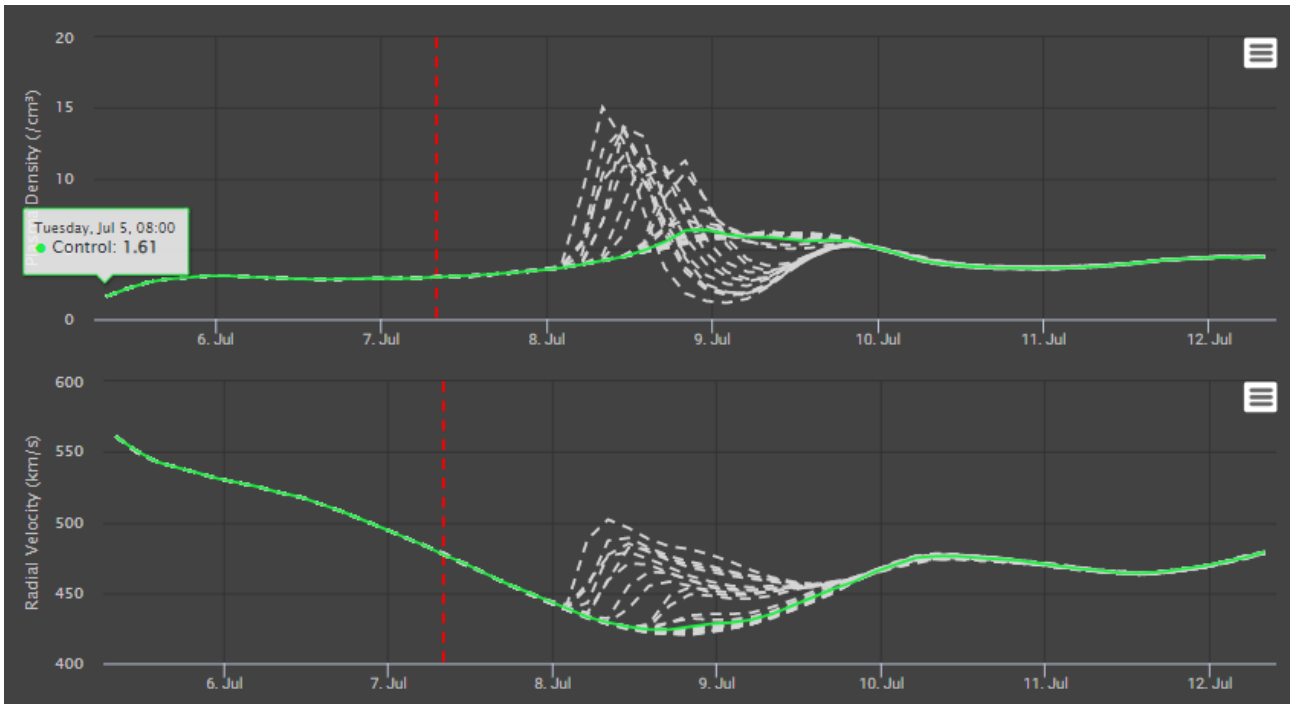
Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
05/0934	Partial	AR3047	SW quadrant	630 km/s	08/1200 UTC	Low confidence – glancing blow possible

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 2: Enlil model and ensemble, showing risk of a glancing blow most likely on 08 July.





Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

There are currently six sunspot regions on the visible disc, which might increase further in the coming days, with potential returning sunspot groups possibly arriving over the eastern limb and no groups of significance departing. The largest region currently visible is AR3053 (Eko/Beta) in the northeast quadrant, but this is not currently showing any significant magnetic complexity. The contribution from eastern limb arrivals (seen in far-sided imagery) is difficult to judge until they become visible, and probabilities have been kept flat for the next four days with a slight chance (20%) for an M-class flare each day.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at background levels, and will most likely remain at this level through the period, in the absence of any significant sunspot development. A slight uptick in probability is suggested on Day 4 (10 July) as AR3053 reaches near centre disc.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	2
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

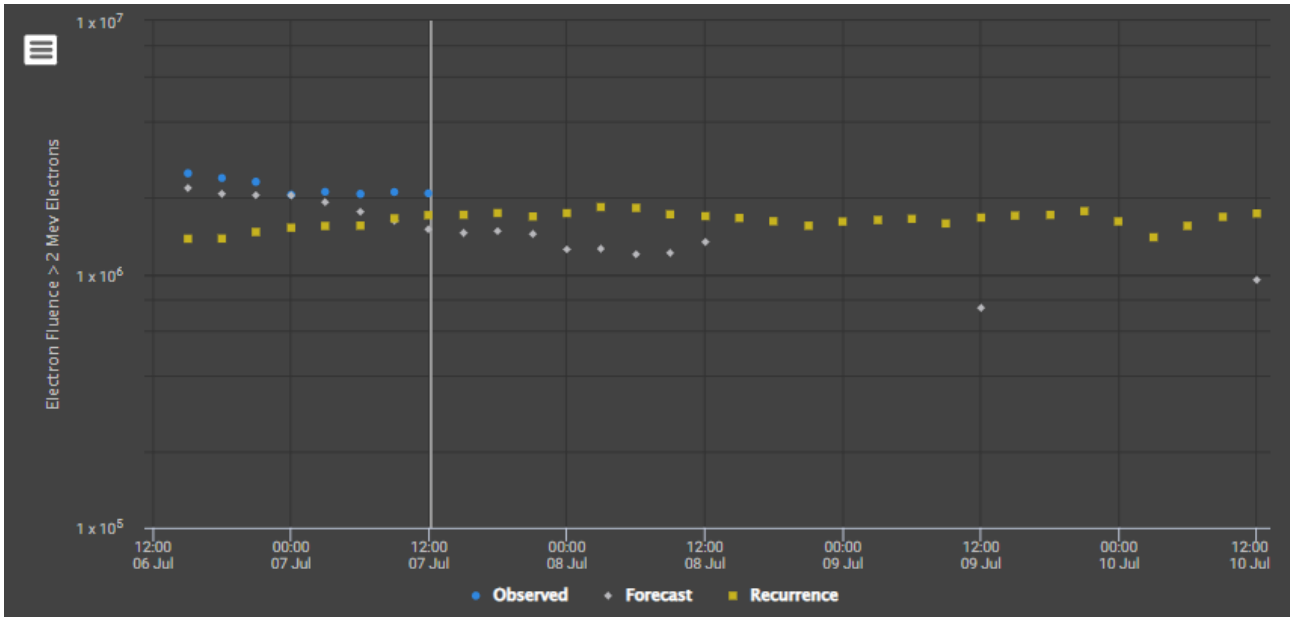
© Crown Copyright 2022. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV) is currently at background levels. Electron flux might increase through this period with anticipated slightly elevated wind speeds from CH97. However, this is beginning to look as though wind speeds may not be sufficient to drive any significant electron charging. In addition a low confidence CME glancing blow is possible on Day 2 (08 July), which would temporarily suppress flux levels if any charging does occur. High (1000 pfu) flux levels might be reached during the diurnal maxima later in the period but with some uncertainty.

Electron fluence is currently well below the Active threshold. Fluence is considered most likely to remain below the Active threshold through the period, although this carries a degree of uncertainty due to the significant difference in coronal hole extent compared to the previous rotation and the possibility of CME effects. An upward trend is possible following any coronal hole connection but with low confidence for the magnitude of this.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	10	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: REFM model showing a steady trend well below the Active (1e8 integrated pfu) threshold. This may be a slight underestimate, although fluence is expected to stay below Active levels.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.